



Stakeholder Consultation on CGIAR Systemwide Initiative on Malaria and Agriculture (SIMA)

**ICRAF Headquarters, Nairobi, Kenya
13–16 May 2001**

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Stakeholder Consultation on CGIAR Systemwide Initiative on Malaria and Agriculture (SIMA)

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Participants at the Consultation

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Acronyms and Abbreviations

AHI	African Highland Initiative
ASARECA	Association for Strengthening Agriculture Research in East and Central Africa
CDC	Centres Directors Committee
CIAT	Centro Internacional de Agricultura Tropical
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
CIP	International Potato Centre
CORAF	Conference des responsables de recherche agronomique en Afrique de l'Ouest et du Centre
DFID	Department for International Development (UK); formerly ODA
EHP	Environmental Health Project
FAO	Food and Agriculture Organisation of the United Nations
ICIPE	International Centre of Insect Physiology and Ecology
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IFPRI	International Food Policy Research Institute
IPGRI	International Plant Genetic Research Institute
IRRI	International Rice Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
ISNAR	International Service for National Agricultural Research
IWMI	International Water Management Institute
MIM/NIH	Multilateral Initiative on Malaria Research in Africa/National Institutes of Health
NRI	Natural Resources Institute (UK)
PEEM	Panel of Experts on Environmental Management for Vector Control
POPs	Persistent organic pesticides
RBM	(WHO's) Rollback Malaria
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WARDA	West Africa Rice Development Association
WHO	World Health Organisation

Introduction

Forty participants attended the SIMA stakeholders Consultation, which took place on 13-16 May 2001 at the ICRAF Headquarters in Nairobi, Kenya. The following institutional categories were represented at the Consultation: CGIAR Centres, other international centers and institutions of advanced research, donors, and National Agricultural Research Centres from six countries from eastern and southern Africa. The participants list annexed at the end of this document provides the details of participants and their institutional affiliations.

The Consultation consisted of presentations of invited papers and extensive plenary and group discussions, and formed the basis of the SIMA ACTION PLAN document, available on-line at <http://www.iwmi.org/sima.html>. The present report highlights the main steps of the consultation process. It tries to document the uninterpreted output of the Consultation, including results of working groups, and group and plenary discussions, some of which could not be included in the ACTION PLAN.

Welcome Remarks

DR PEDRO SANCHEZ, DIRECTOR-GENERAL
INTERNATIONAL CENTRE FOR RESEARCH IN
AGROFORESTRY (ICRAF)

Dr Sanchez welcomed the participants to ICRAF and invited them to visit and enjoy the ICRAF facilities. The Director-General then briefed participants on the Future Harvest Centres, a term currently used to refer to the Centres of the Consultative Group on International Agricultural Research. The CGIAR is a group of 57 investors (i.e. investors that expect a return on their investment) from the North and South, which supports 16 international agricultural research centres, including ICRAF and IWMI. The CG Centres have several inter-centre research initiatives, including the Systemwide Initiative on Malaria and agriculture (SIMA).



The speaker outlined some of the privileges of working within the CG system, including being in an environment of minimal bureaucracy, and the ability to recruit the best staff—worldwide.

He pointed out that the CG raises its operational funds each year —about US \$350 million p.a.—from various global donors, including The World Bank, USAID and others.

The overall goal of the Future Harvest centers is to conduct science and capacity building to achieve food security and poverty reduction and to preserve the natural resource base for future generations. In recognition of the links of agriculture/food security with human health, the CG is currently undergoing a realignment programme, which aims at reaching out and establishing links with other communities, including, in particular, the health sector, to complement its strengths in agriculture with medical expertise. The CG aims at examining the implications of, for instance, global climate change, whose impacts will be particularly serious for 3rd world countries. It has therefore established two systemwide initiatives, one on HIV Aids (SWIHA) and the other on malaria (SIMA). IWMI is spearheading the initiative on malaria, in view of its work on the links between water management and human health.

On the issue of HIV-Aids, Dr Sanchez informed the participants that Kenya has a 30% HIV infection rate. To illustrate this worrying statistic, Dr Sanchez informed the participants that at ICRAF alone, 2–3 deaths occur per week of staff members or their relatives from HIV-Aids.

Dr Sanchez cited examples of NGOs in Kenya that are working with ICRAF, reaching approx. 50,000 people. The NGO Compassionate Agroforestry in western Kenya takes in AIDS orphans and tackles issues of soil fertility (carbon sequestration) to achieve food security, and in this way contributes towards preventing social problems such as the increase of street children and prostitution.

He indicated his anticipation of the results of the SIMA consultation, during the forthcoming MIT meeting in Durban, and wished the participants a fruitful workshop.



Self introduction

The SIMA Coordinator, Dr Clifford Mutero (IWMI), introduced the Consultation's facilitator, Ms Charity Kabutha, to the plenary. A lively self-introduction session followed, in which participants were divided into groups according to the first letters of their first names, and after self-introduction to their group, each participant introduced one of their 'new-found friends' to the plenary.

This method of introduction served to 'break the ice', put the participants at ease and enable everyone to get a better insight into the composition of the Consultation.



Participants expectations, fears and norms

Participants were invited to put down on cards, their expectations, fears and norms for the Consultation.

EXPECTATIONS

These were summarised under 3 broad topics, namely Research, Linkages and collaboration and Strategies/way forward. They are presented here as put down by the participants.

Research

- Learn ways and means of developing research proposals.
- Identify research priorities whose results will translate into malaria control and increased food production in agricultural communities, including those in irrigated schemes
- Gain a clearer knowledge on natural resource management to control malaria
- New ways of managing malaria in rural agricultural areas
- Impact through international media.

Linkages and Collaboration

- Achieve NRM and public health partnership
- Gain new contacts for future collaboration/networking.

Strategies/Way Forward

- Develop a clear approach to the malaria and agriculture issue

- Develop an integrated research agenda and action plan for malaria control that links disciplines
- Identify and agree on bankable research themes for implementation
- Outline SIMA future action.

PARTICIPANTS' FEARS

These were summarised under five categories: Cross-disciplinary mistrust, Lack of clear action plan/follow-up; Time pressure and New challenges.

Cross-disciplinary issues

- Insincerity/hidden agenda
- Difficulties overcoming sectoral reductionist perspectives
- Disciplinary restrictions and confusion resulting from different perspectives
- Dominating group thinking or perspective
- Getting lost in details
- Ignorance on malaria of agriculturists
- Lack of consensus due to too many good suggestions

Lack of a clear action plan/ follow-up

- No proper channels for information dissemination on outcome of proposal.
- Action plan might not be implemented/ some of the suggested issues may not be implementable
- Development of a news story that flops
- Another workshop with good recommendations that will gather dust
- SIMA may become too centralised
- Imprecise outcome of workshop
- Poor concrete plans for support

Time management

- Time limitation for completion of development of plans

New challenges

- Lack of research funds
- Research might be divorced from implementation
- Lack of adequate studies so far on malaria and agriculture

NORMS

The participants expected the following to characterise the Consultation:

- Time keeping and punctuality
- Concerted efforts and dedication
- Full, honest and active participation without jargon
- Good facilitation
- Group discussions
- Useful outcomes to benefit rural poor
- Better understanding of links between malaria and irrigation



Consultation Objectives

Dr Mutero provided participants with a brief overview of the genesis of SIMA (see Annex on Background), and outlined the Consultation's ambitious objectives as being:

- To review and validate SIMA objectives arising from the e-discussion;
- To identify priorities for inter-sectoral action and funding in relation to research, capacity building and information dissemination on the theme of malaria and agriculture;
- To develop an appropriate organisational structure for the implementation of the SIMA programme at the country, regional and global levels;
- To develop research proposal outlines, initially for eastern and southern Africa;
- To prepare a SIMA action-plan proposal document for presentation to the CGIAR mid-term meeting for endorsement and initial funding.



Invited Papers On Socioecological Systems and Health*

HUMAN HEALTH IN AGROECOSYSTEMS PRONE TO MALARIA

DON PEDEN

The speaker presented data on % Loss of Disability Adjusted Life Years (DALYs) from one of the world's 'poorest of poor' countries, Nepal, which is representative of many sub-Saharan African, Asian and Central American countries. Morbidity and mortality in the poorest countries arises mostly from infectious diseases and other 'group 1' health issues, while in established economies, poor health is due to 'group #2' type of illnesses, which include cancer, diabetes, stroke, etc. Children under the age of five bear the brunt of the burden of ill health in poorest countries, and rural areas are harder hit than urban areas.

The speaker presented various definitions of the terms 'human health', 'poverty', 'resources', 'environmental health' [which has a narrower focus than] and 'ecosystem health'. Ecosystem health deals with issues such as ecosystem stability, which cannot be addressed when only individual 'units' of the environment are examined. From an ecosystems perspective every intervention contributes to a new problems. Thus, the new thinking is an interdisciplinary approach, since it is now recognised that human health, agroecosystems and poverty go hand in hand. 'Silver bullets' to solve a particular health problem are not sufficient for long-term health improvement.

The clinical health care systems in rural areas of poor countries are mainly non-functioning, and are sorely inadequate. Approaches must focus on prevention using both ecosystem and public health approaches. Such approaches will help take care of the health of the majority of the population—those with subclinical and non-specific symptoms, as well as solve multiple problems simultaneously. Examples might include the socio-ecology of mycotoxins in Africa. Experience suggests that ecologically based interventions can be effective and cost-efficient in contributing to improved health. In many cases, relying on clinical medicine alone will not suffice.

Malaria exists in complex and often degraded ecosystems, and is just one of many constraints to wellbeing. The study of other ecosystem components and processes—including confounding human health issues such as nutrition, HIV-Aids and other socioeconomic characteristics of the people who live in the ecosystem—will become essential to enable the development of new integrated approaches to health improvement.

One challenge of the ecosystem approach is to ensure the participation of all stakeholders (including local people) from the start, along with adequate consideration of gender. The ecosystem approach leads to 'models' that facilitate multi-stakeholder priority setting and conflict resolution. It enables the systematic selection of behavioural, policy and technological innovations that will collectively improve health and reduce poverty. Malaria control will be most effective when applied in this integrated framework.

SIMA is a key instrument for the future.

*(see Annexes for full presentations)

ENVIRONMENTAL MANAGEMENT FOR DISEASE AND DISEASE VECTOR CONTROL

MOSES CHIMBARI

The linkages (both positive and negative) between development, health and environment were highlighted.

It was made clear that consultative planning of development projects very often impacts positively on the environment and brings significant health benefits. Vector-borne diseases associated with agriculture were listed as malaria, yellow fever, dengue, encephalitis and schistosomiasis (the only one involving a snail host). Habitats for vector mosquitoes and snails were noted to be diverse and associated with development projects, including agricultural activities.

Vector control, chemotherapy and general improvement of facilities were mentioned as strategies for the control of vector-borne diseases. The control of vectors could be achieved by chemical, biological or environmental management. Environmental management for vector control—through permanent or temporary modification of the environment—was seen as a strategy that resulted in a reduction in human-vector-pathogen interactions. Case studies of successful environmental management strategies were highlighted, and it was noted that the approach is very old but is receiving renewed interest.

In conclusion, the Consultation was encouraged to consider environmental management for vector control as a possible, viable option. Advantages of the option were highlighted and it was indicated that the shortfalls of the strategy are normally outweighed by the advantages.

INTEGRATED VECTOR MANAGEMENT FOR MALARIA CONTROL (MAKING IVM WORK IN AFRICA)

CLIFFORD MUTERO

A lively Q&A session kicked off Dr Mutero's presentation, highlighting the following, if little known, facts about malaria and agriculture:

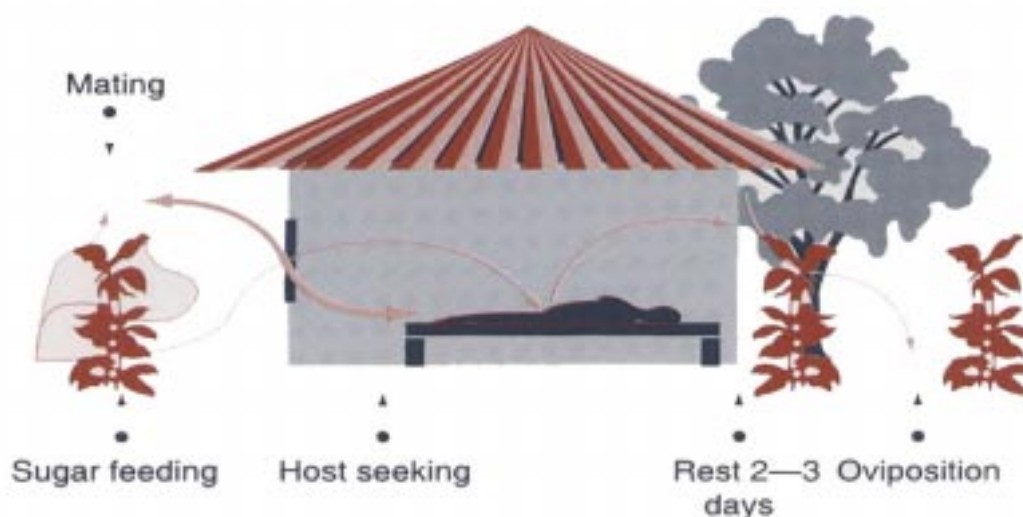
- 40 % of the world's population is at risk from malaria.
- Families affected by malaria cultivate 65% less land than healthy families.
- For every US \$ spent on AIDS research, only \$ 0.001 is spent on malaria research.
- Not all mosquito species transmit malaria.
- 90% of malaria occurs in Africa.
- In Kenya, about 80% of malaria is resistant to chloroquine in certain areas
- Integrated malaria control *is* feasible in Africa.

Its resistance to chloroquine gives malaria a face that's very similar to that of HIV-Aids in rural and poor areas of Africa.

Whereas there is an opportunity to intervene during any of the behavioural stages of the mosquito (sugar feeding, mating, host seeking, blood feeding and oviposition). Interventions have commonly focused on insecticide usage inside houses or on treatment of the disease. An ecosystem approach can intervene in all the life history stages of the mosquito. This approach is being investigated by ICIPE's Human Health programme. It includes wet and dry irrigation, the use of repellent plants (MOS 1 and MOS 2), zooprophyllaxis, *Bacillus thuringiensis* (Bt), neem, filling of water ponds, etc.

However, bottlenecks to integrated vector management (IVM) occur at the community, technical (scientific) and policy levels, and all these need to be tackled in a holistic fashion.

In conclusion, there needs to occur a paradigm shift towards participatory research approaches that encourage different stakeholders to genuinely buy into projects and claim ownership.



Diagrammatic representation of the behavioural cycle of African malaria mosquitoes

Q & A SESSION

- Q. Has the influence of cattle dips on mosquito populations been studied?
 A. In USA and China studies have focused on using treated cattle as lethal baits for mosquito populations .
- Q. Have any studies been carried out to investigate the links between tsetse control and malaria (mosquito) control?
 A. No, but such research is desirable.
- Q. Have any links been found between malaria transmission and lymphatic filariasis and others waterborne diseases?
 A. None known

COMMENTS:

- The CGIAR is dealing with urban and periurban agriculture, and its related emerging problems.
- In Tanzania, cattle/humans proximity is increasing because of urbanization/ economic hardships (cattle are now kept in small city dwellings).
- SIMA should ensure that its way forward doesn't become so focused on research as to ignore operational programmes.
- IPGRI, one of the CG centres, is studying the impact of Green Revolution technology on the Third World's poor, and developing sustainable livelihood strategies and processes.
- The distribution of malaria is bound to change according to global climate change, and any new approaches must bear this in mind.
- It is foreseen that bednets treated with pyrethroids will become ineffective in malaria control in the not too distant future.

SOCIAL ISSUES IN HEALTH RESEARCH AND DISEASE CONTROL: AN AFRICAN PERSPECTIVE

CHARITY KABUTHA

Ms Kabutha started her presentation by reminding participants that the ultimate purpose of research is to reach people and impact positively on their lives. Thus, people can determine the success or failure, and influence the validity of research efforts.

In any community, researchers must be aware of the different kinds of groups that exist, including those based on gender, ethnicity (and culture), nationality, age and class. Religious and cultural barriers are a potential pitfall to research, and can derail both health research and disease control.

Their (the people's) access to and control over resources are primary determinants of whether they will work with researchers; those people in the community with wealth (money) and knowledge are typically more accessible to researchers.

On social issues, the speaker underlined the need for researchers to appreciate and manage diversity in a community, which, if ignored, hinders the research process or generates invalid results. On this issue, she highlighted the invisibility of the very poor, especially women, and challenged researchers to devise ways through which to reach this important cluster, if a community's entire diversity



is to be represented. Some of the factors that contribute to the invisibility of some groups in a community are:

- being too busy working on many different jobs, and
- living too far from highways, thus being inaccessible to researchers.

The speaker pointed out that cultural issues have a direct implication to a group's vulnerability to disease. For instance, in sub-Saharan Africa, women work for almost double the amount of time that men do. In irrigated rice schemes, this makes them twice as prone to water-borne diseases as their male counterparts.

Any new technologies developed must be tailored to suit the people in a community if they are to be successful; they must be affordable and sturdy. For instance, mosquito nets have proved to be impractical in a Kenyan irrigation scheme in which an entire family often sleeps together in a small room.

On the issue of information dissemination, the speaker pointed out the need for multiple methods of passing on information to all stakeholders, both the literate and illiterate.

In conclusion, the speaker emphasised the importance of researchers clustering the groups in their chosen society, and of not forgetting the small minorities—who may present major complexities, but are nonetheless central to the achievement of health and disease control.

COMMENTS

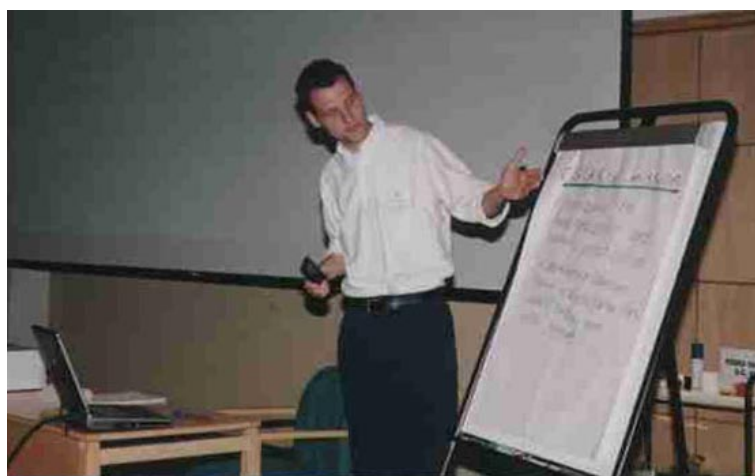
- An important and growing borderline cluster of society in the Third World that should be borne in mind is children affected by HIV-AIDS.
- Because of HIV-AIDS, agricultural practices are changing. For instance, people are shifting from the keeping of bigger to smaller animals e.g. from cows to goats, since AIDS is affecting the stronger and more productive generation, leaving agricultural work to the very young and the very old. Any new technologies must be tailored to accommodate this shift.



Report on SIMA electronic discussion

FLEMMING KONRADSEN

Dr Konradsen presented the synthesis report of the February to April 2001 electronic discussion (see Annex). Although no major consensus seems to have been reached on the research focus, the following broad themes emerged as priorities for SIMA's R&D activities.



- Bibliography on malaria and agriculture – compile and consolidate to avoid repetition of work
- Insecticidal, repellent and anti-parasitic plants
- Agricultural insecticides and resistance (collaboration with WHO's Roll Back Malaria)
- Nutrition
- Assessing climate change link to highland malaria
- Livestock and malaria transmission
- Forestry-coffee growing
- Social issues, impact assessment
- Institutional overlaps
- Limited scope of malaria research – e.g. nomadics are not covered
- Contribution of small dams to malaria
- Human health and irrigation management and infrastructure
- Demographic changes
- Use of advanced technologies (risk mapping using GIS, etc.)

The electronic discussion received few comments on SIMA's institutional structure.

COMMENTS ON ELECTRONIC DISCUSSION

- Four divisions at ICIPE – Human, Plant, Animal and Environmental health—work together in an interdisciplinary approach to IPM and IVM.
- SIMA would serve to catalyse interdisciplinary R&D internationally.
- SIMA's focus should try to remain malaria and not health as a whole, since many donors fund specific areas of research.
- Remote sensing, GIS technologies remain underused by the health sector.
- The Global Challenge programme of the CG is working on nutrition, health (including malaria) and natural resources [thus SIMA will need to carve its niche].

- Poverty reduction and natural resource management should be included among SIMA's objectives.
- SIMA might supplement ongoing initiatives – especially those that don't take into account the agriculture-health link
- UNEP chemicals is working towards the elimination/reduction of POPs in agriculture and disease vector control operations (see Annex)
- SIMA's awareness raising and capacity building activities could embrace other issues, e.g.HIV, but focus initially on malaria.
- There is inadequate representation of the private sector at the Consultation to discuss SIMA's research agenda. WHO's Rollback Malaria is not represented (invited but could not attend).



Working Groups on SIMA purpose, objectives, priority themes and activities

Breakout themes were formed to discuss and develop a statement of SIMA's purpose, a list of objectives and priority areas of research and activity for presentation and discussion in Plenary. The participants were asked to work with the following broad premises in mind, which had emerged from the Consultation thus far.

General considerations

- Address decision makers
- Address policy issues
- Pay attention to harmony and conflicts
- Take advantage of existing networks
- Be clear re: stakeholder roles
- Be clear why linking health into CG

Institutional collaboration with

- RBM & MIM, AHI, etc
- National Health and Agriculture ministries
- Research institutions

Desired outputs and impacts

- Increased collaboration among institutions and individuals
- Improved knowledge
- Actual interventions
- Documentation of impacts of malaria on productivity, income

Added value of SIMA

- Opportunity for truly interdisciplinary research at the international level
- SIMA work will complement that of RBM and clinical medicine (disease treatment)
- SIMA may spearhead health research within the CG by establishing links with the human health sector bring new actors and form the basis for future funding opportunities within the CG system.

Research focus

CG – NARS interaction helps keep reality check.



PURPOSE OF SIMA – GOAL, MISSION STATEMENT

A number of Statements of Purpose for SIMA were proposed:

1. Enhance human health and agricultural production through improved stakeholder awareness, cross-sectoral capacity building and collaborative and integrated applied field research on agroecosystem management for malaria reduction.
2. Promote sustainable agricultural development through lessening the incidences of malaria with an emphasis on enhancing environmentally sound management of natural resources.
3. Promote sustainable agricultural development through research and other action to address linkages among agriculture, natural resource management and malaria.

PRIORITY THEMES

The following emerged as the priority areas of activity envisaged for SIMA

1. Information, Advocacy and Awareness

To increase understanding at all levels and facilitate the exchange of information, technologies and policies on the linkages between malaria and agroecosystems.

Activities

- To compile and consolidate available literature on the linkages between malaria and agriculture, in order to avoid repetition and foster collaboration.
- To develop and disseminate appropriate resource materials and initiate activities that sensitise the public and policy makers on the links between agricultural practices and malaria.

2. Training and Capacity Building

To enhance capacity for inter-sectoral research on health and agriculture with special focus on malaria

Activities

- Joint training in health and agriculture at various levels (extension agents, graduate programs, policy makers).
- Training in: impact assessment; malaria monitoring; grant writing and funds procurement
- Community participation in vector management
- Income-generating activities around alternate control technologies

- Use existing training tools devised by international agencies such as UNEP, WHO and FAO
- Improvement of facilities
- Assess and mobilise existing facilities

3. Research⁺

Plant based anti-mosquito, anti-malaria and anti-crop pest products are researched, documented and field-tested.

Identify and improve sustainable modifications to existing agricultural systems to reduce the mosquito habitat.

Identify and demonstrate changes in agricultural practices that reduce malaria risk.

The following thematic areas were the priorities envisaged for SIMA:

1. Ecosystem and spatial analyses of malaria
 - Criteria and indicators relevant to Malaria, Health and sustainable NRM
 - Ecosystem description - determinants and casual links
 - Integrative tools (GIS), conflict resolution, etc.
2. Agricultural techniques that impact malaria
3. Agrochemicals, livestock
4. Medicinal plants – inventory and conserve
 - Identification and conservation
 - Application of molecular techniques
 - Field testing (scaling up)
5. Nutrition
 - Impacts on malaria
 - Malaria impacts on nutrition/food security and poverty
6. Socioeconomic factors

COMMENTS ON MISSION STATEMENT, OBJECTIVES AND ACTIVITIES

- Trans-sectoral linkages among stakeholders should appear in objectives
- The term ‘Agriculture’ is too limiting, since NRM and agriculture are part of other activities within a complex ecosystem, including migration, etc.
- Examine agricultural impacts on malaria and vice versa.
- It might be better for SIMA to focus only on malaria rather than human health generally.

⁺See Annex

- Other methods apart from GIS should be applied for finding the spatial distribution of malaria.
- A major challenge is to bring health, biophysical engineering and governance to the village level.
- A logical flow in the objectives might be useful: land use patterns might be studied, the environment characterised, hypotheses set, followed by research, awareness raising, capacity building and risk reduction.
- SIMA-developed interventions might be pilot tested using the CG networks.
- A 2nd level meeting to cover all the CG centres should be organised, and should include participants from all over the world where malaria is a problem
- National systems are the starting point for SIMA- grassroots impression
- Take an inventory of all institutions of all activities on malaria in eastern and southern Africa initially, in order to find the niche for SIMA and avoid duplication of efforts.
- Look at relationship between cropping systems and malaria (draw from ICIPE/IWMI project on ecosystem practices currently at Mwea).
- Investigate how cash crop farming affects/changes behaviour of farming, timing, etc. and how people are exposed to contaminants Sri Lanka Example. Bed nets become ineffective. Look at household behaviour as part of water ecosystems – e.g. water storage, etc (incorporated).
- Determine trends in agroecosystems with climate change.
- Challenge current healthcare systems assumptions (e.g., that people always sleep at night, in beds).
- Looked at practices and policies related to malaria and agriculture and NRM.
- Undertake research, conservation into anti-plasmodial plants using biotechnology.
- Investigate agrochemicals usage (pesticides, herbicides, acaricides, etc.) vis-à-vis the Stockholm Convention (see Annex)
- Include gender issues
- Other possible areas for SIMA work:
 - Malaria in rainfed vs. irrigated farming systems
 - Highland vs. lowland schemes
 - Role of livestock, e.g. zero-grazing vs. freehold methods in relation to mosquito/malaria incidence
- Study the linkages between malaria and agricultural productivity and food security, nutrition and poverty (see Annex)
- Undertake collaborative IPM/IVM

PURPOSE STATEMENT AND OBJECTIVES

Following the discussions, the Goal and objectives of SIMA, as distilled from the foregoing discussions and endorsed by the Consultation, are as follows:

Goal

Reduced incidence of malaria resulting in less human suffering, increased agricultural productivity, and poverty alleviation.

Objectives

- Analyze the linkages between malaria and agriculture;
- Assess the impact of malaria on agricultural productivity and poverty;
- Identify and demonstrate agricultural practices and agricultural development strategies that reduce malaria risk;
- Build understanding in the health and agricultural sectors on the linkages between human health and agriculture with special focus on malaria;
- Enhance capacity for inter-sectoral research on health and agriculture with special focus on malaria.

Country proposals

Three Working Groups were assigned tasks as follows:

1. Eastern Africa – Kenya, Tanzania, Uganda
2. Southern Africa – Mozambique, South Africa, Zimbabwe

With the task to define:

- Expectations of SIMA/CGIAR
 - Comparative advantages of NARS in malaria R&D, and national health institutions in agriculture
 - Priority research themes
3. CGIAR, international institutions and donors with the task to draft:
 - The organisational structure of SIMA
 - Tasks, responsibilities

The outcomes of their discussions were then presented to the plenary.

EASTERN AFRICA

Overall Priority Theme: Research into Agroecosystems and Malaria (High Technology)

Many agroecosystems of priority within the CGIAR are at risk for or suffer from severe malaria. To a large part the determinants of malaria are rooted in the structure and NRM practices. Research into and characterization of agroecosystems and their link to malaria and health will allow SIMA to build on work already done by other CG centers. This wealth of information can be used to focus on specific problems while adding information that will give insight into aspects of the ecosystem that foster health and agricultural productivity

Analyzing this data using tools such as GIS, modeling and decision analysis theory, as well as others, will identify indicators of importance to all major stakeholders and elucidate the causal linkages in this complex system. This will open up opportunities for multi-stakeholders to select from sets of interventions to reduce malaria and improve health.

The SIMA consultation has identified research in agroecology systems as a major area of research.

Uganda

Priority themes:

Agricultural techniques that impact on malaria

Ecosystem and spatial analyses of malaria

Potential collaborating national research institutions

a) Water

- Agricultural Engineering and Technology Research Institute, Nomalere Research in water management
- Water Management Division, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) – Capacity building

b) Agrochemical and livestock pesticides

- Serere Agricultural and Animal Research Institute (SAARI) – Agrochemical research
- Livestock Research Institute (LIRI)- Livestock pesticides research on cattle dipping and pour-on formulations

c) Fish farming

- Fisheries Resources Research Institute (FIRRI) – Research
- Department of Fisheries (MAAIF) – Capacity building

d) Malaria transmission and agro-systems

- Institute of Public Health (IPH) – Research and training
- Vector Control Division (VCD) – Research, training, control, pesticide use, resistance to pesticides and bioassays

- LIRI- Research, control, pesticide resistance and bioassays
- Makerere Institute of Environment and Natural Resources (MIENR) – Research and capacity building in GIS and remote sensing
- National Environment Management Authority (NEMA) – Policy development on agro-ecosystems
- Forest Research Institute (FORI) – Research in agroforestry
- Faculty of Agriculture (MUK) – Capacity building
- Meteorological Department – Climate Change
- Kawanda Research Station – Research in soil types

Tanzania

Priority theme

Research into agricultural systems and their impact on the malaria burden with the view to improving human health and increasing agricultural productivity.

Indicators

1. Farming systems and malaria
 - (a) Crop production – dry irrigation, wet irrigation
 - (b) Livestock –intensive (urban and peri-urban)
extensive (nomadic, free-range)
2. Water usage
 - Rainfed,
 - Irrigated
 - Hand-watered
3. Insecticidal plants (neem), fertilisers
4. Socio-economics



Potential collaborating national research institutions

(a) National health institutions

National Malaria Control Programme
National Institute for Medical Research
Muhimbili University College of Health Science

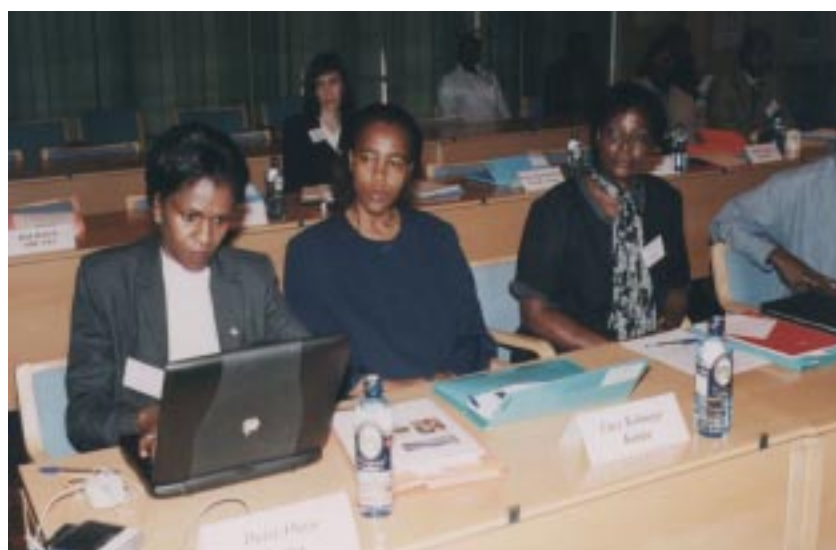
(b) NARS

Sokoine University of Agriculture
Tanzania Forestry Research Institute
Tropical Pesticides Research Institute
Kilombero Agricultural Training and Research Institute
Animal Disease Research Institute

Kenya

Potential collaborating national research institutions

Jomo Kenyatta University of Agriculture and Technology (JKUAT)
University of Nairobi (UoN)
Kenyatta University
Ministry of Agriculture and Rural Development (MoARD)
National Irrigation Board (NIB)
Kenya Forestry Research Institute (KEFRI)
Kenya Agricultural Research Institute (KARI)
Regional Centre for Remote Sensing (RCRS)
Kenya Institute for Survey and Mapping (KISM)
National Environmental Secretariat (NES)
Department of Remote Sensing and Resource Survey (DRSRS)
Meteorological Department
Kenya Medical Research Institute (KEMRI)
Ministry of Health (MoH)
National Museums of Kenya (NMK)
Kenya Plant Health Institute (KEPHIS)
African Medical and Research Foundation (AMREF)
International Centre of Insect Physiology and Ecology (ICIPE)



SOUTHERN AFRICA

Priority Research Themes

1. Insecticide resistance monitoring/research
2. Impact of water development projects/agriculture on malaria transmission
3. Investigations on the use of medicinal plants for malaria control

Expectations from SIMA:-

- a)
 - Funding
 - Research
 - Information Exchange
 - Advocacy at national level
- b)
 - Capacity Building
 - Training
 - Equipment, etc
- c) Umbrella National Committee to cover linkages, provide technical advice.

Comparative advantages of NARS in malaria research and NIHS in Agriculture

- a) Strategic Planning
 - Facilitate the approval of projects (Environmental Laws)
 - Incorporate disease prevention measures
 - Maximise the use of the existing resources
 - Generation of new funds
 - Dissemination of information between two types of institutes will result in more effective malaria control
 - Help in changing pesticide use practices

Organisational structure

FACILITATOR: FLEMMING KONRADSEN

GENERAL CONSIDERATIONS/PREMISES

SIMA Secretariat

- Secretariat will continue to be hosted at IWMI (ICRAF campus) – with a Coordinator and a secretary.
- IWMI will remain as the host institution and take care of formal responsibilities. CG centres overall responsible for projects.
- SIMA Secretariat hosts a network- forum for discussion, exchange of ideas by institutions and individuals and produces an electronic and/or printed newsletter and other publications.

Independent Projects

Manage implementation, management, etc.

Advisory Group of Experts

All CGIAR centers with a stake in SIMA to become members of Advisory Group.

Other members to be appointed from international centres of excellence and national programmes.

Functions: To review proposals, provide direction, etc.

A number of Sub-committees proposed:

- IPM
- IVM
- Medicinal plants

DRAFT ORGANISATIONAL STRUCTURE— PRESENTED BY JOHN HILBORN:

Starting points considerations

1. Transparency
2. Main objectives of SIMA
3. Structure: secretariat, Advisory Committee (science-based), Steering Committee
4. Start-up structure

Premises:

- Institutions:
 - on board
 - others
- What will everybody do
- Form (institutional structure) will follow function
- Listed functions
- Did not consider who would do what
- Did not commit to the need of a secretariat

Priorities:

Competitive grant system (on website)

Maintaining website

Meetings follow up

Discussion forum (electronic and printed)

*Capacity/partnership building

Fundraising (resource expansion)

Library (virtual, physical)

Newsletter

*Promoting identification of projects

Reviewing protocols of medical ethics, research methodology

Linkages with existing initiatives

Accountability to donors

Keep to objectives

Information dissemination (briefs, etc), technology transfer

Evaluation of intercentre initiatives (on MTM site)

*Partnership building, fund raising

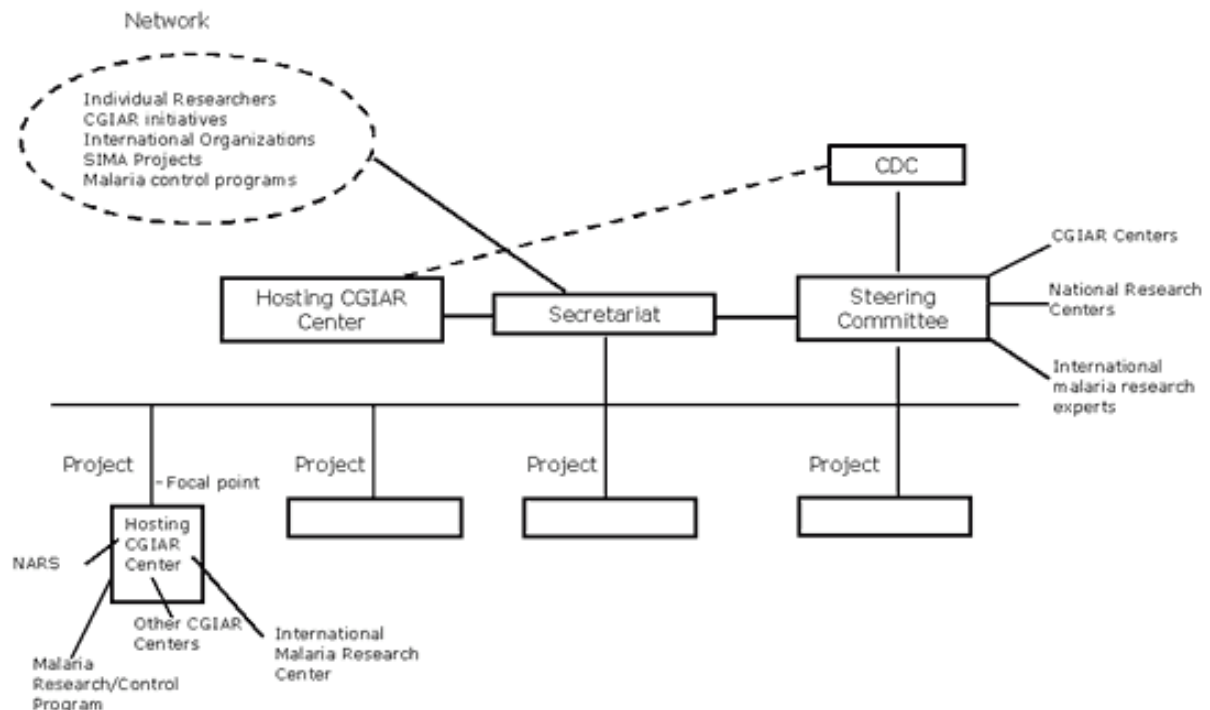
*Capturing CG experience

*Top priorities

DISCUSSION ON ORGANIZATIONAL STRUCTURE

- Establish horizontal linkages at within country level?
- Rollback Malaria should be represented on SIMA's Advisory Group.
- SIMA could sign MoUs with similar initiatives
- Have external and internal advisory committees
- SIMA Secretariat responsible to CDC?
- Subcommittees unnecessary; rather establish specific networks
- Articulate functions, decisions, and money flow
- Use focal points- links to NARS, African Highlands Initiative
- Don't reinvent the wheel – some of SIMA's research might be built into ongoing existing research.
- Discuss accountability
- SIMA accounts to IWMI financially via the Advisory Committee
- Advisory Committee reports to the CDC – Committee will contain DG of IWMI or a representative
- Communication of all 3 entities should be articulated
- Determine how the structure will link with NARS activities
 - Secretariat deals with national partners, which have been identified
 - Should have ownership at country level – proposals submitted jointly w. similar institutions to achieve this
 - Focal points which understand the CG system at country level to assist country programmes develop proposals for submission through SIMA
- NARS to do outreach and extension, and ensure reality checks at field level
- Proposal submission forms, formats, etc to be made available on the SIMA Web page
- Steering committee comprised of national representatives (focal points) and others (int'l institutions, etc) – achieves equity and ownership [but has financial implications].
- Piggyback some of SIMA's activities on existing eco-regional initiatives, e.g African Highland Initiative (AHI)
- ASARECA's secretariat is too lean to serve as SIMA's subregional representative, and its focus is different from SIMA's.
- National level representation is crucial.
- SIMA could apply for funds from donors such as USAID to organise special sessions at international meetings of health and agriculture to serve as forums for the exchange of results of SIMA's R&D activities.

The SIMA organization structure as derived from the foregoing discussion and ratified by the plenary was presented by Flemming Konradsen.



ELEMENTS OF THE ORGANISATIONAL STRUCTURE

Management

- Steering committee- (national, int'l research committee), decides on strategic issues, monitors progress and reports to the Centres Directors Committee.
- IWMI to have financial responsibility to the CDC.
- Secretariat hosts network (projects, NGOs, donors, others) through various activities – main funding activities.
- SIMA secretariat continue to be based at ICRAF, Nairobi
- SIMA accountant to be based at IWMI Colombo (?)
- Call for proposals to be made by SIMA
- Focal points: individuals to develop proposals (unpaid, not hired by SIMA)
- Proposals to be developed not just for research, but also for other priority themes as defined
- People-driven and project-driven network
- Global initiative, but initial projects from E/S Africa region

Links

Informal links with MIM, AHI, Rollback malaria, etc.

Activities

Documentation Centre – reference information (bibliography)

E-mail discussion to continue, home page, regional activities (organise meetings, virtual or real, etc.)

Steering committee

SC Membership to be derived from SIMA focal points and stakeholders.
Membership to SC will be by nomination.

Focal points

SIMA could organise meetings at the country level for all players – to generate research ideas.

Elaborate TOR for both the Steering committee and the SIMA Secretariat

- SIMA Secretariat acts as a clearinghouse for projects from national organizations – for funding by IDRC, USAID, DFID, etc (fundraising role of SIMA coordinator)

Build in overheads for SIMA into projects, to assist in sustainability of SIMA.

Timetable for SIMA

PRESENTED BY ELINE BOELEE

Timetable for SIMA - first phase

Activity	2001				2002				2003				2004				2005			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Electronic consultation																				
Stakeholders workshop																				
MITM meeting																				
Wider CG consultation																				
Submission full SIMA proposal																				
Mobilise funding																				
Formalization SIMA Secretariat																				
Formation SIMA Steering Committee																				
Call for proposals																				
Project development																				
Project research																				
Networking																				
Capacity building																				
Dissemination																				



CLOSING DISCUSSIONS:

- Following the MTM's endorsement of SIMA in Durban, a full SIMA proposal will be presented by IWMI during Centres Week in Washington
- National level consultations can start right away – NARS were encourage to invite the SIMA coordinator to their consultations
- Put deadlines to the field projects, which could start right away and evolve in parallel with organization of SIMA. E.g. USAID could fund SIMA-coordinated projects right away, e.g. work on community-based vector interventions.
- SIMA could solicit funds for creating /sponsoring symposia at American Society for Tropical Medicine/British TM annual meetings, where results of SIMA projects could be shared. There will be a major forum in USA during the second quarter of 2003, and the RBM/MIM meting in Arusha in October 2002 where SIMA could conduct a special session on Malaria and Agriculture
- USAID will give avail its funding conditions, scope, etc to SIMA
- A loose Consortium of interested parties by individual institutions and donors might serve as a pressure group to the CDC during the Centres Week
- USAID-EHP supports WHO/AFRO (African network of vector ecologists and disease control practitioners). There will be a WHO/AFRO Consultation in February to develop guidelines. WHO/AFRO should be a key partner of SIMA for activities in this region.

Closing remarks:

CLIFFORD MUTERO

Dr Mutero noted with satisfaction that a network of friends and colleagues interested in the SIMA agenda had been established at the Consultation and expressed the wish that this network would prove to be long-lasting and fruitful.



Annexes

LIST OF PARTICIPANTS

SIMA BACKGROUND DOCUMENT

CONSULTATION PROGRAMME

PAPER PRESENTATIONS

UNEP CHEMICALS PRESENTATION

EASTERN AFRICA GROUP

POWERPOINT PRESENTATIONS

CHART OF HEALTH-AGRICULTURE INTERLINKAGES

LIST OF PARTICIPANTS

Dr Abamu, Frank
Agronomist/Crop Modeller & Focal Point
on HIV/AIDs
West Africa Rice Development Association
(WARDA)
01 BP 2551
Bonake 01
Cote d' Ivoire
Phone: +225 31 68 4514
Fax: +225 31 68 4714
E-mail: f.abamu@cgiar.org

Dr Bodker, Rene
Entomologist
DBL
2920 Charlottenlund
DENMARK
Phone: +45 77 327732
Fax: +45 77 327733
E-mail: rb@bilharziasis.dk
pf@bilharziasis.dk

Dr Boelee, Eline
Researcher in Health and Irrigation
International Water Management Institute
(IWMI)
P O Box 2075
COLOMBO – SRI LANKA
Phone: +94 1 867404
Fax: +94 1 866854
E-mail: e.boelee@cgiar.org

Mr Brantly, Eugene P.
ECHO Program Co-ordinator
Environmental Health Project
1611 No. Kent St. #300
Arlington Virginia -USA
Phone: +703 247 8723
Fax: +703 243 9004
E-mail: brantlyep@ehproject.org

Dr Chancellor, Tim
Vector Entomologist
Natural Resources Institute
Chatham Maritime
UNITED KINGDOM
Phone: +44 (0) 1634 883466
Fax: +44 (0) 1634 883379
E-mail: t.c.b.chancellor@gre.ac.uk

Mr Chirebv, Elijah
Medical Research Entomologist
Min. Of Health & Child Welfare,
Blair Research Institute,
De Beers Research Laboratory

P. O. Box 197
CHIREDDI – ZIMBABWE
Phone: +263 31 3020
Fax: +263 31 4171
E-mail: debeers@mweb.co.zw

Dr Chimbari, Moses
Director
University Lake Kariba Research Station
P. O. Box 48
KARIBA – ZIMBABWE
Phone: +263 91 252754
Fax: +263 61 3035
E-mail: ULKRS@telco.co.zw

Ms Ferrara, Patricia
Malaria Control Program Activity Manager
USAID, Mozambique
Caixa Postal 783
MAPUTO – MOZAMBIQUE
Phone: +258 1 490726
E-mail: pferrara@usaid.gov

Dr Githure, John
Head, Human Health Division
ICIPE
P O Box 30772
NAIROBI – KENYA
Phone: +254 2 861686
Fax: +254 2 860110
E-mail: jgithure@icipe.org

Dr Hallman, Kelly
Research Fellow
IFPRI
2033 K St. NW
WASHINGTON DC 20009 – USA
Phone: +202 862 8146
Fax: +202 467 4439
E-mail: k.hallman@cgiar.org

Dr Hilborn, John
Chief, Chemical Conventions Division
UNEP
P O Box 30552
NAIROBI – KENYA
Phone: +254 2 624543
Fax: +254 2 623926
E-mail: john.hilborn@unep.org

Mr Kamau, Cyrus Chege
Research Officer
Kenya Agricultural Research Institute
Research Officer/Admin. & Finance
Coordinator

JKUAT/AICAD
P O Box 75466
NAIROBI-KENYA
Phone: +254 2 789903
Fax: +254 0151 52030
Email: jkurpe@nbnet.co.ke

Dr Kiambi, Dan
Scientist, Genetic Diversity
IPGRI
P O Box 30677
NAIROBI – KENYA
Phone: +254 2 524506
Fax: +254 2 524500
E-mail: D.Kiambi@cgiar.org

Dr Knausenberger, Walter
Regional Environmental Advisor
USAID/REDSO
P O Box 30261
NAIROBI – KENYA
Phone: +254 2 862400 Ext.2267
Fax: +254 2 860562
E-mail: wknausenberger@usaid.gov

Dr Konradsen, Flemming
University of Copenhagen
Institute of Public Health
Department of International Health
Panum
Blegdamsvej 3
2200 Copenhagen N
Denmark
Phone + 45 35 77 76 (direct)
Fax + 45 35 32 77 36
E-mail: f.konradsen@pubhealth.ku.dk

Dr Lwande, Wilber
International Centre of Insect Physiology
and Ecology
P O Box 30772
NAIROBI – KENYA
Phone: +254 2 802501/861680
Fax: +254 2 803360
E-mail: wlwande@Icipe.org

Mr Madyiwa, S.
Principal Irrigation Specialist
Department of AGRITEX
CY 639
HARARE – ZIMBABWE
Phone: +263 4 794601/9 or 707311/2
Fax: +263 4 730525
E-mail: ULKRS@telco.co.zw

Mr Magayane, Machibya
Research Fellow

Water Management Specialist
Sokoine University of Agriculture
Soil-Water Management Research Group
P O Box 3003
MOROGORO – TANZANIA
Phone: +255 023 2603511-4 Ext. 4435
Fax: +255 023 2604649
E-mail: mmagayane@hotmail.com or
Swmrg@suanet.ac.tz

Mr Manguze, Manuel
Irrigation Technician
Ministry of Agriculture
P O Box 2272
MAPUTO – MOZAMBIQUE
Phone: +258 1 415103
Fax: +258 1 415103
E-mail: dnha@zebna.wem.mz

Dr Mboera, Leonard E.G.
Senior Research Scientist
National Institute for Medical Research
P O Box 9653
DAR ES SALAAM – TANZANIA
Phone: +255 222130770
Fax: +255 222130660
E-mail: lmboera@hotmail.com

Prof. Mlozi, Malongo R.S.
Associate Professor
Sokoine University of Agriculture
P O Box 3002 CHUO KIKUU
MOROGORO – TANZANIA
Phone: +255 23 2604795, 2603511(O)
Fax: +255 23 2604649/2604562
E-mail: Dae@suonet.ac.tz
Mmlozi@yahoo.com

Mr Mohloai, Peter
Scientist
Medical Research Council
P O BOX 17120
DURBAN – SOUTH AFRICA
Phone: 0027312043600
Fax: 0027312051498
E-mail: mohloaip@MRC.AC.ZA

Mr Mugisha, Samuel
Researcher/Lecturer
Makerere University, Institute of
Environment and Natural Resources
P O Box 7298
KAMPALA – UGANDA
Phone: +256 41 530135
Fax: +256 41 530134
E-mail: muienr@imul.com

Dr Muriuki, Anne
P O Box 57811
NAIROBI – KENYA
Phone: +254 2 583301
Fax: +254 2 583344
E-mail: AWMuriuki@Kari.org

Dr Mutero, Clifford
SIMA Co-ordinator
IWMI
C/O ICRAF Box 30677
NAIROBI – KENYA
Phone: +254 2 524751
E-mail: C.mutero@cgiar.org

Dr Mutitu, E.W.
Chairman, Dept. of Crop Protection
University of Nairobi
P O Box 30197
NAIROBI-KENYA
Phone: +254 2 631277
Fax: +254 2 632121

Mr Okello, A.S.
Director, Crop Resources
Ministry of Agriculture, Animal Industry
and Fisheries
P O Box 102
ENTEBBE – UGANDA
Phone: +256 41 320187
Fax: +256 41 321010

Dr Okello-Onen, Joseph
Senior Research Officer
Livestock Health Research Institute
P O Box 96
TORORO – UGANDA
Phone: +256 77 449517
E-mail: jonen65@hotmail.com

Mr Okia, Eluga Michael
Senior Entomologist
Malaria Control Programme
P O Box 7272
KAMPALA – UGANDA
Phone: +256 41 231563/9 / 256 75
613921
Fax: +256 41 231584
E-mail: mcpug@afsat.com/esd@afsat.com

Dr Peden, Don
Senior Program Specialist
IDRC
P O Box 8500
OTAWA, CANADA, K1G 3H9
Phone: +1-613-236-6163
Fax: +1-613-567-7749
E-mail: dpeden@idrc.ca

Dr Rapuoda, Beth A.
Co-ordinator
East Africa Network for Monitoring
Antimalarial Treatment (EANMAT) DOMC
P O Box 20750, NAIROBI, KENYA
Phone: +254 2 716934
Fax: +254 2 716935
E-mail: eanmat@africaonline.co.ke

Mr Rassul, Mario Jorge
Managing Director
IMPACTO MAPUTO – MOZAMBIQUE
Phone: +258 1 492783/93
Fax: +258 1 493019
E-mail: IMPACTO@IMPACTO.co.mz

Dr Rukunga, Geoffrey M.
Director, Centre for Traditional Medicine
and Drug Research
Kenya Medical Research Institute
P O Box 54840, NAIROBI – KENYA
Phone: +254 2 722518
Fax: +254 2 720030
E-mail: rukunga@yahoo.com
Rukunga@hotmail.com

* Ms Sunden, Agneta
Scientific Affairs Officer
UNEP Chemicals
15, Chemin des Anemones
1219 Chatelain, GENEVA
SWITZERLAND
Phone: +41.22.9178193
Fax: +41.22.7973460
Email: asunden@unep.ch

Mr Solzberger, Edward
Journalist, Future Harvest
P O Box 480
GALVESTON – TEXAS – USA
E-mail: E.SULZBERGER@CGIAR.ORG

Dr Walsh, Barbara
P O Box 2389
KISUMU – KENYA
Phone: +254 035 22352/ 0733-769959
E-mail: bwalsh@africaonline.co.ke

Dr Walker, Kathleen
IPM Specialist
USAID, Office of Agriculture and Food
Security
RRB 2.11 – 102
1300 Pennsylvania Ave. NW
WASHINGTON D.C. – USA
Phone: +202 712 1116
Fax: +202 216 1050
E-mail: kwalker@usaid.gov

*Contribution presented by John Hilborn

FACILITATORS

Ms Kabutha, Charity
Facilitator
Private Consultant
P O Box 75608
NAIROBI – KENYA
Phone: +254 2 513338
E-mail: Ckabutha@hotmail.com

Prof. Kimani, Violet Nyambura
Co-facilitator
Chairman, Dept. of Community Health
University of Nairobi
P O Box 19676
NAIROBI-KENYA
Phone: +254 2 724600/39
Fax: +254 2 724600/39
Email: Violetki@comhlth.ac.ke

Dr Kabuage, Lucy
Co-facilitator/Lecturer
University of Nairobi
P O Box 29040
NAIROBI – KENYA
Phone: +254 2 631487
Fax: +254 2 631487
E-mail: Kabuage@net2000ke.com

Ms Ouya, Daisy
Rapporteur/Science Editor
ICIPE
P O Box 30772
NAIROBI – KENYA
Phone: +254 2 861680-4
Fax: +254 2 860110
E-mail: douya@icipe.org

SIMA BACKGROUND DOCUMENT

At a meeting of the Centers Directors Committee of the Consultative Group on International Agricultural Research (CGIAR), held during the International Centres Week (ICW2000) in October 2000, the International Water Management Institute (IWMI) was requested to explore the possibility of setting up a system-wide initiative on malaria and agriculture (SIMA). The request was prompted by the need to better understand certain links between agriculture and malaria, a disease that has been responsible for untold human suffering and death, especially in Africa.

As a first major step in the exploratory process, an electronic discussion on SIMA was launched in January 2001 through the SIMA website at www.iwmi.org/sima.htm. The following seven questions were circulated among subscribers to the SIMA listserv, with the objective of gathering views to help shape the SIMA research agenda.

1. There are many institutions and health groups currently involved in different aspects of malaria research and control. What added value can a research initiative on malaria and agriculture bring to this effort?
2. There are many cross-cutting aspects to malaria and agricultural research (e.g. integrated vector management, health and socio-economic impacts, water and land management aspects, options for integrating medicinal plants and immunity-boosting food crops; seasonal agricultural migration patterns; livestock management etc.). What other aspects should be the core of this research?
3. What study locations and types of environments should be chosen for this research, and what should be the selection criteria?
4. Should SIMA keep an exclusive focus on agriculture and malaria or take a broader ecosystem approach to human health with malaria as the entry point?
5. What past research and existing publications should be used as the basis for this initiative?
6. What should be the target groups, desired outcome and impacts of this research?
7. Assuming that CGIAR will continue hosting a small SIMA coordination secretariat based at the International Water Management Institute (IWMI), what would you suggest as an appropriate institutional framework for achieving the initiative's objectives (summarized in the e-discussion)?

The next step in the exploration process after the lively electronic discussion (which tapered off in early March) is the SIMA stakeholders consultation, to be held from 13–16 May 2001 in Nairobi, Kenya. Recommendations from the Nairobi consultation together with those from the e-discussion will later be presented to CGIAR for further action.

Consultation objectives:

The stakeholder consultation will be held from 13–16 May 2001 in Nairobi, Kenya, with the following specific objectives:

- To review and validate SIMA objectives arising from an electronic discussion set up in February 2001 to gather views from a wide cross-section of stakeholders.
- To identify priorities for inter-sectoral action and funding in relation to research, capacity-building, and information dissemination on the theme of malaria and agriculture.
- To develop an appropriate organizational structure for the implementation of the SIMA programme at the country, regional and global levels.
- To develop research proposal outlines, initially for Eastern and Southern Africa.
- To prepare a SIMA action-plan proposal document for forwarding to CGIAR mid-term meetings (May 21–25) for endorsement and initial funding.

Participants:

About 40 participants are expected to attend the Nairobi consultation. The participants have been invited from among various potential partners including:

- CGIAR Centres
- Other international agricultural research centers (IARCs)
- Ministries of agriculture, health, water development, environment, science and technology, in Eastern and Southern Africa
- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
- International and regional malaria research and control programmes
- Donor representatives.
- Non-governmental organizations
- Private sector

CONSULTATION PROGRAMME

IWMI/IDRC/USAID-SUPPORTED STAKEHOLDER CONSULTATION ON THE CGIAR SYSTEMWIDE INITIATIVE ON MALARIA AND AGRICULTURE (SIMA), NAIROBI, KENYA 13-16 MAY 2001

SUNDAY 13 MAY

Arrival of participants

MONDAY 14 MAY

0800-0900

Registration at the International Centre for Research in
Agroforestry (ICRAF)

0900-0915

Welcome remarks by Dr. Pedro Sanchez, ICRAF Director General

0915-1000

Self-introduction

1000-1015

Overview of Consultation objectives

1015-1030

TEA BREAK

1030-1230

Invited papers on socio-ecological systems and health:

- *Agroecosystem management for improved human health – D. Peden*
- *Environmental Management for disease and disease vector control – M. Chimbari*
- *Integrated vector management for malaria Control – C. Mutero*
- *Social issues in health research and disease control: An African perspective – C. Kabutha*

1230-1400

LUNCH

1400-1430

Report on SIMA electronic discussion – F. Konradsen

1430-1530

Discussion

1530-1600

TEA BREAK

1600-1630

Introduction to working groups on SIMA objectives

1630-1730

Working group discussions on SIMA objectives

1830-1930

Reception at ICRAF

TUESDAY 15 MAY

0830-1000

Report back on group discussions

1000-1030

TEA BREAK

1030-1100

Introduction to working groups on organizational structure

1100-1230

Working group discussions on org. structure

1230-1400

LUNCH

1400-1500

Report back on organizational structure

1500-1530

Introduction to proposal outlines

1530-1600

TEA BREAK

1600-1800

Group discussions on proposal outlines

WEDNESDAY 16 MAY

1830-1000

Group discussions on proposal outlines

1000-1030

TEA BREAK

1030-1200

Report back on proposal outlines

1200-1300

Final discussion and closing session

1300

LUNCH AND DEPARTURE

PAPER PRESENTATIONS

ENVIRONMENTAL MANAGEMENT FOR DISEASE AND DISEASE VECTOR CONTROL

M.J. CHIMBARI

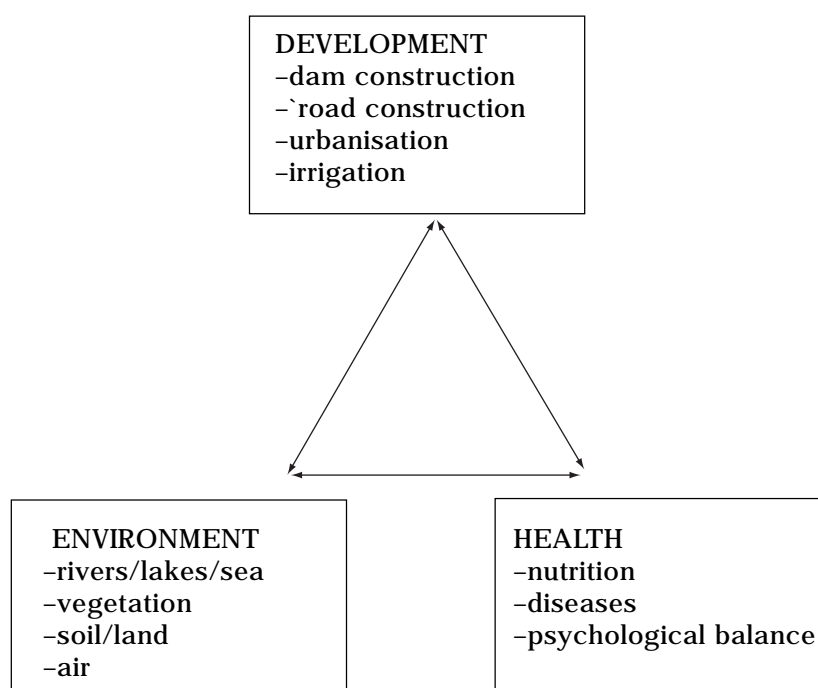
UNIVERSITY LAKE KARIBA RESEARCH STATION

P.O. BOX 48

KARIBA

Summary

- Introduction
- General strategies for disease vector control
- Environmental management strategies
- Examples of E.M. cases
- Conclusion



Vector Borne Diseases

- Malaria
- Yellow fever
- Dangué haemorrhagic fever
- Encephalitis
- Schistosomiasis

Vector habitats

- night storage ponds
- reservoirs
- rivers
- irrigation infield structures
- irrigation canals

- borrow pits
- open containers
- tall grass
- drainage channels
- marshy areas

Strategies for control of vector borne diseases

Vector control	→	reduce vector numbers
Chemotherapy	→	reduce parasite reservoir
HE & Improved facilities	→	reduce vector-person interactions

Vector control options

- Chemical
 - developmental inhibitors
 - insecticides/molluscicides
 - attractants
 - repellants
 - chemosterilants
- Biological
 - microbial insecticides
 - genetic manipulation
 - introducing competitor/predator species
- Environmental Management
 - personal protection
 - marsh alteration
 - house screening, bed nets
 - filling, grading and drainage
 - basic sanitary measures

Environmental Management

Activities	Output	Ultimate goal
Planning Organisation Carrying out Monitoring	Modification and/or manipulation of environmental factors	<ul style="list-style-type: none"> • reduction of vectors • human/vector/pathogen contact

ENVIRONMENTAL MODIFICATION

- Permanent physical transformation of environment to prevent, reduce or eliminate vector habitats without compromising quality of human environment.
 - drainage; land levelling; land filling; special impoundment/irrigation structures
- Reduction of human contact with infective vectors.
 - zooprophylaxis; modification of human habitations; changing human behaviour

ENVIRONMENTAL MANIPULATION

- Temporary creation of conditions unfavourable to breeding of vectors in their habitats.
 - stream flushing
 - reservoir water level fluctuation
 - manipulating salinity
 - vegetation removal
 - shading
 - intermittent irrigation
 - expanded polystyrene beads

SUSTAINABLE APPROACHES IN PEST AND VECTOR CONTROL AND OPPORTUNITIES FOR COLLABORATION IN REPLACING POPs PESTICIDES: UNEP'S PERSPECTIVES IN THE LIGHT OF THE FUTURE STOCKHOLM CONVENTION ON POPs

by Dr John Hilborn on behalf of UNEP Chemicals

In 1997 the UNEP Governing Council decided that international action to reduce and eliminate releases of an initial list of twelve Persistent Organic Pollutants (POPs) was urgently needed. It requested UNEP to prepare and convene negotiations of an international treaty for implementing such international action as well as a procedure and criteria for adding further POPs as candidates for international action. Among the twelve POPs there are nine pesticides:

aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene.

The major issues that could be identified regarding remaining uses of these pesticides were:

- the use of chlordane, heptachlor and mirex for control of termites, and
- the use of DDT in disease vector control.

Countries will under the future convention be able to continue the use of DDT for vector control where no locally safe, effective, and affordable alternatives are available. The draft treaty text, which will be adopted and opened for signature next week, 22-23 May 2001, in Stockholm, requests that Parties report the conditions of such use of DDT every three years. The further need of DDT will be regularly evaluated by the Conference of Parties (COP) in consultation with WHO. Country-specific exemptions for other pesticide uses will expire 5 years after the Convention enters into force. Further extensions for up to 5 years may upon requests be decided by the COP.

In addition to preparing for and convening the negotiations, UNEP was also requested by the Governing Council to initiate a number of immediate actions on POPs, including guidance and expertise regarding alternatives to the POPs pesticides. In working with FAO through the Global IPM facility and WHO through the secretariat of the Panel of Experts on Environmental management (PEEM) work to promote sustainable approaches in pest and vector control and opportunities for collaboration between sectors started with a workshop in Bangkok last year.

The main objective with these workshops is to promote co-operation between health, agriculture and the environment in the reduction / elimination of POPs pesticides, and in particular DDT to ensure that the alternative approaches will be effective (i.e. not run into problems of resistance due to use in other fields) and sustainable through the implementation of integrated management measures with an overall reduction in the use of alternative pesticides.

In addition, UNEP Chemicals has developed a number of information products on both chemical and non-chemical alternatives that are or will shortly become available on the POPs Website <http://chem.unep.ch/pops/>:

- Database on alternatives to POPs
- Address database to experts
- Collection of studies and action plans to replace/reduce releases of POPs
- Discussion forum on POPs and special issues

Further to this, UNEP Chemicals is in co-operation with WHO and FAO developing a some guidance materials that should be followed by training products that can be used for particular uses and situations, including farmer field schools.

Jointly with FAO and the Global IPM Facility UNEP has also established an international expert group on termite biology and management, which has established a workplan to develop information products on the biology and management of different types of termites. UNEP together with FAO facilitates the co-operation, provides the Internet node and limited financial support for meetings, development of the information products and can help identify funding sources for research projects. This group could be compared to some extent with the SIMA group, in that it brings experts together that agree on the way they want to work together, workplans and priorities. UNEP Chemicals would, hence, be interested in discussing a similar co-operation with SIMA as a partner. We would be particularly interested in facilitating the development of information, guidance, and training materials that can help promote collaborative IPM/IVM studies and assist countries in setting up pilots and developing implementation plans that incorporate such collaborative strategies.

Many agroecosystems of priority within the CGIAR are at risk to or suffer from severe malaria. To a large part the determinants of malaria are rooted in the structure and NRM practices.. SIMA will build on existing CG system research by including the two-way linkages to malaria and other related human health issues. The approach will identify indicators of importance to all major stakeholders and identify the causal linkages. This will open up opportunities for multistakeholder selection of sets of interventions (policy, modeling techniques) to reduce malaria and improve health.

Research into agroecosystems and their link to malaria and health will allow SIMA to build on work already done by other CG centers to focus on specific problems while adding information that will give insight to aspects of the ecosystem that foster health. A wide variety of tools exist (GIS, modeling, decision analysis systems) to formulate this information to analyse trends and help define interventions that will improve outcomes for all stakeholders.

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EASTERN AFRICA GROUP

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The SIMA consultation has identified research in agroecology systems as a major area of research. A number of problems have been identified that arise from and contribute to the spread of malaria carrying mosquito populations characterizing those factors which can lead to leveraged interventions and draws on the existing work of the CG's. Combining this expertise in tool development and analysis

SOUTHERN AFRICA GROUP

1. Expectations from SIMA
 - a) Funding
 - Research
 - Information Exchange
 - Advocacy at national level
 - b) Capacity Building
 - Training
 - Equipment, etc

NATIONAL COMMITTEE (TO MAKE UMBRELLA TO COVER LINKAGES)

- Provide technical advice.
2. Comparative Advantages
 - a) Strategic Planning
 - Facilitate the approval of projects (Environmental Laws)
 - Incorporate disease prevention measures
 - Maximise the existing resources ...
 - Generation of new funds
 - Dissemination of information between “two” will result in more effective malaria control
 - Help on changes on pesticide uses

TOP 2

1. Insecticide resistance monitoring/research
2. Impact of water development projects/agriculture on malaria transmission
3. Investigations on use of medicinal plants for malaria control